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Economic Evaluation of Paddy Seeder in Sandy Loam Soil for Short Duration Rice Variety

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Abstract

The economic performance of seeder was evaluated for short duration rice variety (Prabhat) over the conventional system in experimental plot. For transplanting rice under traditional system on mat type on seedling was used direct sowing of rice done the same day, the seeds for mat preparation were spread on bed. Twenty two day seedling was transplanted by traditional method in Treatment T_2. The performance of drum seeder was evaluated under treatment T_1 with respect to actual field capacity (0.17 ha/h) and ultimately the field efficiency (62%) and conventional system of rice cultivation i. e. manual transplanting. The yield attributes like plant height (83 cm) no. of effective tillers/m^2 (127), no of grains/panicle (112), 1,000-grain weight (24.48 g) in treatment T_1 were found to be superior over treatment T_2 (manual transplanting). The effect of weed emergence in bath the treatments T_1 and T_2 were at par in treatment T_1 (34.829/ha). It was the higher yield capacity of drum seeder followed by higher yield that resulted into more benefit-cost ratio of 1.27 in treatment T_1 than 1.05 in treatment T_2. Thus for their situation the experiment was conducted, rice cultivation with drum seeder was found to be economical, time saving and labor saving as compared to conventinal method (manual transplanting) of rice cultivation.

Key words : Paddy seeder, Economic evaluation, Rice variety, Sandy loam soil.

Rice in pre-dominantly produced labor intensive cultivation practices its production and processing absorbs much labor, time and money. Agricultural mechanization has gained importance in some Asian countries. It has improved time lines in operation and increased cropping intensite (1—3). In conventional method of rice transplanting the manual labor requirement for transplanting operation is the main factor behind increasing the cost cultivation. This has decreased the profit of the farmers. Bihar is the state where almost 60% of cultivable land is flood affected. The severe flood was the seed bed and farmers are left with no seeding for further transplanting operation when the flood water recedes. After receding of flood water, the soil remains soft enough and without weed. This provides a favoralde opportunity for growing rice by putting the seed (unsprouted and sprouted bath) into the soil. When seeds are sown by broadcasting method, plants do not come out in a definite pattern. The plants start competition and interfere to each other for sunlight and air. Thus the yield is reduced. Keeping these factors in mind the studies were mode to evaluate performance and economics of rice seeder, and to find out the effect of rice cultivation system (direct seeded us transplanted)over weed emergence and plant growth recorded.

Methods

Climate

The climate of Pusa is humid hot dry summer and mild winter. The maximum rainfall is from south west monsoon. The maximum average temperature goes upto 45C in May-June and minimum around 4 to 5C in December -January. The average rainfall (annual) is 1,200 mm between June to October.

Sail Type

The soil of experimental plot was sandy loam with the details given below.

Characteristic		Composition
1	Bulk density (G/cc)	1.4
2	pH	8.3
3	Electrical conductivity (mmhaus/cm)	0.65
4	Infiltration (mm/h)	4
5	Water holding capacity (%)	23
6	Permanent wilting point (%)	9.3
7	Available water (%)	12.5

Crop

Crop establishment i. e. plant growth at successive intervals of 15 days after 35 days of seeding , no. of effective tillers/m^2 no. of grains panicle, 1,000 grain weight recorded.

The rice seeder sows rice seeds in line and at a definite row to row spacing, thus this machine can be efficiently used by the farmers particularly in north Bihar situation, where flood is a regular feature. Many short duration varieties of rice having good potential yield in north Bihar situation, Prabhat variety of rice which has the seed to seed maturity period of 105—110 days and potential yield of 40—45 g/ha can be the best option for farmers of north Bihar for increasing their profitability. The sprouted seeds of some variety if sown through drum seeder in puddle soil after receding of flood water can have same the cost of transplanting. On one side while on other, farmers will also get side of the problem of Seed bed preparation and seeding growing No doubt by this measure farmers can utilize even the land which they keep uncropped due to unavailability of seedings after food and thus can increase their profitability by securing more rice in the area they owned.

Description of Paddy Seeder

Power source	TNAU Make (manual one man)
Weight (kg)	16
Rated width (mm)	1200
No. of rows	8
Row spacing (cm)	15 cm
Materials of construction	Aluminum sheet, Ms hallow rod
No. of hales/drum	70
Larger wheel/dia (cm)	60
No. of drum	4

Seed

In short duration varieties, such as Prabhat, Richhariya Kasturi, Pusa 834, Prabhat has good yield potential and it produces course grain. Another factor which motivated for the selection of Prabhat variety is its wider adoptability amongst the farmers of North Bihar.

Details of Treatments

Treatment (T_1) = Rice cultivation by direct seeding of seed by paddy seeder; Treatment (T_2) = Rice cultivation by transplanting seeding grow in seed bed (farmer's practice). Both the treatments were laid down side by side for easy movement of machine and to achieve higher field efficiency. Fourteen replications were taken in each treatment to minimum the variability in observational data recorded due to soil tap grapy and other factors. Law out and treatments were as given below.

A (T_1)		A (T_2)	
R_1T_1	R_3T_3	R_8T_2	R_2T_2
R_5T_1	R_7T_1	R_5T_2	R_3T_2
R_2T_1	R_9T_1	R_1T_2	$R_{10}T_2$
R_4T_1	R_6T_1	$R_{11}T_2$	$R_{14}T_2$
$R_{11}T_1$	$R_{14}T_1$	R_7T_2	R_4T_2
$R_{12}T_1$	$R_{13}T_1$	R_9T_2	R_6T_2
$R_{10}T_1$	R_8T_1	R_2T_2	$R_{13}T_2$

Growing of Seedling

At first the paddy seeds were treated with salt solution for two hours. The seeds were then put into a big container filled with fresh water for soaking. The seeds floating on the surface were removed. After 24hours, the soaked seed were put into a gunny bag. The bag was kept in a dark room for sprouting of seeds. The sprouting of soaked seed usually taken 24 hours.

For glowing seedlings, a bed of size 1.5 m × 2 m was selected. The bed was well leveled and near the source of water. The polythene sheet was taken in approprite size. The wooden frame was placed over the polythene sheet. Now the fragile top soil free from stone, weeds and other foreign materials was properly mixed with compost in the proportion of 3 :1 so to make a homogeneous mixture the soil-compost mixture was put over the polythene sheets in uniform thickness upto the level of wooden frame. The sprouted seeds were then spread uniformly over the bed to maintain requisite seed rate of 0.6 kg/m^2 the seeds were covered with paddy straw to save it from birds. Water was sprinkled over the seeds at least 4—5 times a day. After 3—4 days when the seedlings become greenish, frame was removed and bed was properly bounded with soil. The paddy straw and weeds were removed carefully. After that water was

applied in the bed as per requirement. The 22 days seedlings were used for transplanting in control treatment.

Preparation of sprouted paddy seed for direct seeding in order to get the sprouted paddy seed, the seed was initially put into the water mixed with common salt for 2 hour. The hallow floating seeds were removed. Then the seed was put into a vessel filed with fresh water for 24 hours for soaking. Soaked seeds were removed next day from the vessel and poured into a wetted jute bag. The bag was then tied and placed in dark place for next 24 hours. The sprouted seed was then used in drum seeder for direct sowing for rice in the experimental field.

Measurement of Parameters

Paddling Index. Just after paddling, fine samples of the paddle soil from various locations the field ware taken and put into the graduated glass cylinder. The soil particles were allowed to settle for 48 hours. The volumes of settled soil were measurred and then paddling index was calculated be the following formula to evaluate the quantity of soil tilth.

$$PI = \frac{Vs - Vc}{Vs} \times 100$$

Where PI = Pudding index in percent, Vs = Volume of sample (Soil + water) in cc Vc = Volume of clear water in cc after, Settling of soil particles for 48 hours.

Plant Growth at Different Stages. Plant height at 15 days interval after 35 days of seedling was recorded at 14 places in each treatment upto 95 days of plant age. The average of all observations provided the average plant height on that day. All observations were recorded with meter scale.

Weed Population. Weed population is an important parameter which affects the yield significantly. The weed population/m^2after 35 and 65 days of seedling were taken. The first weeding was done after 35 days of seeding in bath treatment.

Field Capacity and Field Efficiency. The theoretical field capacity was calculated based on the formula given below.

$$\text{Theoretical field capacity} = \frac{s \times w}{10} \text{ha/h}$$

Where S = Linear speed of travel of machine in Km/h, W = Width of operation of machine in meter,

$$\text{Actual field capacity (ha/h)} = \frac{A}{\frac{4}{T \times 10}},$$

A = Area of plat M^2, T = actual time taken to caver the area, h (including lasses),

$$\text{Field capacity \%} = \frac{\text{Actual field capacity}}{\text{Theoretical field capacity}} \times 100$$

No. of Affective Tillers/M^2. Numbers of effective tillers/m^2 were recorded in bath the treatments at 14 locations taken randomly. The mean average of all observation provided the no. of effective tiller/m^2 for bath treatment.

Grain Yield. The grain yield in each treatment was taken randomly at 14 locations in one square meter area. The average of all those observations for each treatments provided average grain yield/m^2 for bath treatments. The grain yield was converted to per hectare area basis by multiplying the yield/m^2 with factor of 10,000.

Results and Discussion

The field capacity and field efficiency show that the actual field capacity of rice seeder under local condition of Pusa was found be 0.17 ha/h.with field efficiency of 62%. The total time taken to cover 1 hectare land indicates that machine can be operated maximum by two person for one hectare area in a day as compared to 50 men days requirement for transplanting the same area under conventional system. The data on field capacity and field efficiency reveal that rice cultivation with drum seeder is labor and time saving as compared to the conventional system especially under flood situation.

Plant Growth

The growth of plant in bath in bath treatments was recorded at 15-day intervals having first obser-

Table 1. Observed data on weed population.

Treatment	No. of weed/m^2
After 35 Days of Seeding	
T_1	6
T_2	4
After 55 Days of Seeding	
T_1	2
T_2	3

vation after 35 days of seeding. The data on plant height in both the treatments indicate that rate of growth of plant in treatment T_1 was faster than treatment T_2 in the begining, where the seedlings from mat were transplanted after 22 days of seeding on seed bed. In treatment T_2 initially the growth rate was slower upto 50 days of plant, however the same became faster upto 80 days of plant age. The plant height in treatment T_1 upto 95 days of age revealed that the rice crop in treatment T_1 had more height than treatment T_2. This might be because of method of seedling preparation in treatment T_2 where plant upto 22 days of age were not in cantact with the soil obviously this might have caused nutrients deficiency in plant early stage of plant.

Crop Establishment

Crop establishment methods being different in two treatments, number of effective tillers/m^2, no. of grain/panicle, 1,000-grain weight in both treatments were recorded. The data on no. of effective tillers/m^2 in treatment T_2 (129) was at par with treatment T_1 (127). However, no. of grain/panicle in treatment T_1 (112) was found to be superior over no. of grain/panicle in treatment T_2 (108). Similarly treatment T_1 was found to be superior over treatment T_2 for 1,000-grain weight (24.48 and 23.51 g, respectively) in two treatments. The difference in 1,000-grain weight and no of grains/ panicle might be because of more availability of sun light and nutrients in treatment T_1 as compared to treatment T_2 where the seeds were shown in live at a fxed row to row distance.

Weed Population

Weed emergence in direct seeded rice being a major constraint, puddling is the operation which performs to reduce the rate of emergence of weed, the observations on paddling index on bath the treatments were also recorded. The observed data on paddling index taken as the average of three replications indicate that there was no significant difference in puddling index of treatment T_1 (73.2%) as compared to treatment T_2 (72.6%). Similarly weed population was recorded after 35 days (before first weeding) and 65days (before second weeding of seedling. In first observation i.e. after 35 days of seeding weed population per m^2 treatment T_1 was found over and above to be almost similar to the treatment T_2 (Table 1).However weed population/m^2 at 65 days of plant life (after first weeding and before 2nd weeding) was found lies in treatment T_1 as compared to treatment T_2.

Yield of Crop

The yield attributes (Table 2) show that treatment T_1 with 34.82 q/ha yield was found to be superior over treatment T_2 with yield of 32.75 a/ha.

Economics of Crop Production

The economics of rice cultivation presented as benefit cost ratio at per hectare basis indicated that the treatment T_1 with benefit cast ratio 1.27was superior over treatment T_2 with benefit cost ratio

Table 2. Observed data of grain yield/ha

Treatment	No. of effective tillers/m^2	No. of grain panicle	No. of grain/m^2	1000 grain weight (g)	Grain weight/ m^2 (kg)	Grain yield (q/ha)
T_1	127	112	14224	24.48	0.3482	34.82
T_2	129	108	13932	23.51	0.3275	32.75

Table 3. Economics of crop production.

Treat-ment	Cost of cultivation (Rs/ha)	Cost of produce (Rs/ha)	Benefit cost ratio
T_1	19,685.00	24,931.00	1.27
T_2	22,271.00	23,449.00	1.05

1.05 (Table 3). The higher benefit cost ratio in treatment T_1 was because of more yield and less labor requirement in treatment T_1 as compared to treatment T_2.

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